

Note on the Association of Helium and Thorium in Minerals

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corresponding lines in the Crucian and Alnitamian stars, which come higher up the temperature curve than the Rigelian, seems to leave no doubt as to the genuineness of the identification.

The Rigelian group of sulphur lines has not been detected in ϵ Orionis, though one or two of the strongest lines have been traced in the best Kensington spectrum of Bellatrix (Crucian). The following represents the relative and inverse behaviour of the two sets of lines in stellar spectra.

Group.	Type star.	Sharp lines (4254, 4285).	Diffuse lines.
Alnitamian	ϵ Orionis	Well shown	Absent
Crucian	γ Orionis	Present, but weaker than in ϵ Orionis	Strongest lines present, but weaker than in β Orionis
Rigelian	β Orionis	Absent	Well shown

Note on the Association of Helium and Thorium in Minerals.

By the Hon. R. J. STRUTT, F.R.S.

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The question has been often raised of whether or not helium is a product of thorium radio-activity. My own view throughout has been that it is.* Mr. Boltwood has recently argued that the helium in radio-active minerals may always be attributed to the action of the uranium-radium series of transformations.† I wish in the present note to draw attention to a case where that view is clearly untenable.

Prof. Julius Thomsen, of Copenhagen, described, in 1898,‡ a helium mineral from Ivitgut, Greenland, similar in some respects to fluor spar, but containing rare earths. Recently he has determined the quantity of helium liberated on heating as 27 c.c. per kilogramme.§

Prof. Thomsen kindly sent me a supply of this mineral. I have carefully tested it for radium, and find that it contains no more than the traces which are ubiquitous in rocks and minerals. The quantity found was, in fact, about

* 'Roy. Soc. Proc.' vol. 73, p. 191, 1904, also March 2, 1905.

† 'Am. J. Sci.' vol. 23, February, 1907, p. 77.

‡ 'Zeits. Physikalische Chemie,' vol. 25, part 3.

§ 'Bull. de l'Acad. Royale des Sciences, Copenhagen,' 1904, 53—57.

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the same as in average rocks, and is insufficient to account for one-hundredth part of the helium present.

On the other hand, a solution of the mineral gave abundant thorium emanation. I am inclined to think that there is some unknown complication about the thorium-emanating power of solutions, which makes it unsafe, in certain cases at least, to infer from it the quantity of thorium present. But enough thorium emanation was given off by the solution to show that thorium was a substantial constituent of the mineral. I regard it as entirely certain that the helium in this mineral has not been generated *in situ* by uranium or radium, and have no hesitation in connecting it with the presence of thorium.

On the Measurement of Temperatures in the Cylinder of a Gas Engine.

By Professor H. L. CALLENDAR, F.R.S., and Professor W. E. DALBY, M.A.,
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1. *Introductory.*—It is important in the experimental investigation of the internal combustion engine to be able to measure directly the temperature of the working fluid at some point of the cycle. If the temperature at a suitable point of the cycle is known, the laws of gases enable us to calculate the temperature at any other point during compression and expansion from the indicator diagram on the assumption that the mass remains constant and that the molecular change occurring in combustion is known. The method usually employed has been to estimate the temperature at the beginning of compression (the temperature at this point is sometimes referred to as the "suction temperature") by computing the total mass of the cylinder contents at this point from a knowledge of the gas and air supply and an estimate of the temperature and mass of the contents of the clearance space. But this is an indirect and troublesome method, and some of the data required are extremely uncertain. Direct measurements of the temperature in the cylinder under working conditions have hitherto failed for various reasons. Professor F. W. Burstall* was the first to employ the platinum thermometer for this purpose. He used wires 0·0025 and 0·0015 inch in diameter, and obtained a good deal of valuable information from his experiments, but he

* 'Phil. Mag.,' June, 1895.